SECTION 3.2

FUELS

I. INTRODUCTION

Effects to fire behavior were identified from scoping comments as a Key Issue. Changing fire behavior by reducing the potential for surface fire to transition to crown fire is also a major component of the BCLMP's purpose and need to increase the resiliency of the ecosystem to future wildland fires. Goals for changing fire behavior are as follows:

- Create a distribution of forest age classes, structure and surface fuel conditions that is more resistant to high-severity stand replacement wildfire.

- Move Fire Regime Condition Class (FRCC) towards a FRCC rating of 1 to allow natural fires to burn with low severity and more frequency.

The BCLMP area is located in eastern Montana on the north end of the Ashland RD. Elevations range from 3200' to 4074' and topographic features are typical of southeastern Montana, with rolling hills to steep terrain with saddles and ridges. This area has overriding geological features dictated by moderate changes in elevation zones, variations in topography and climate regimes, depending on aspect. These general components along with other determinants such as temperature, effective precipitation, and hydrologic regime tend to dictate the vegetation components of the area.

The forested areas within the BCLMP area have an extensive predominance of Ponderosa pine (*Pinus Ponderosa*). Ponderosa pine in the BCLMP area occurs in rather diverse habitat types. The driest of these forest types have very open stands with short trees (35-60 feet tall). Moist north-facing slopes have dense stands of Ponderosa Pine (70-95 feet tall), with abundant shrub and herb undergrowth. The area also has shrub-steppe, meadows and riparian complexes.

Historically, frequent low-intensity fires cleared dry ponderosa pine forests of brush and grass but left trees alive and healthy (Graham, et. al, USDA, 2004). It would not have been uncommon to see blackened bark on the lower portion of the boles of most of the overstory trees. The majority of the landscape was comprised of relatively open canopy stands. Stand replacing fire events were uncommon, and tended to occur over less than 12% of a geographic area (See DEIS Fuels Specialist Report - Appendix C in the Project Record). High severity burning (greater than 75% mortality of the overstory trees) was limited to the closed canopy of mid and late development structure classes or during times of extended drought (Table 3.2.1.).

Fire has been excluded from the landscape due to decades of fire suppression policies. Custer National Forest fire suppression records indicate that 25 fires less than ten acres each were successfully suppressed in the BCLMP area from 1985 to 2010. Fire suppression activities, drought and other activities have resulted in greater tree densities and a buildup of down woody

material and ladder fuels across large areas of the forest landscape. These changes have created a mechanism for surface fires to develop into intense stand replacement crown fires. In the past 25 years, several large, high severity fires occurred near the BCLMP area on the Ashland RD including:

- Stag -- Tobin Fire Complex: 69,872 acres
- Wheatwell Fire: 2,690 acres
- Schiller Fire: 15,250 acres (552 acres within BCLMP area)
- Wild Fire: 1,800 acres

These fires were located to the immediate west, north, east, and south of the analysis area. All of these large fires exhibited extensive stand replacement across the landscape and were difficult to control due to increased intensities, spotting, and spread rates of large scale crown fires. The combined Stag – Tobin fires eventually totaled over 69,000 acres on the Ashland District and adjacent lands. Although the fires were large, they were not all consuming. The fire burned in a mosaic patterns that reflect interspersed pines and grasslands. However, the Stag area experienced high fire severity resulting in 95-100% vegetation mortality across 40-50% of the landscape. Additional high intensity, stand replacement fires have occurred in similar ponderosa pine ecosystems elsewhere on the Custer National Forest, including the 1988 Brewer Fire and 2002 Kraft Springs Fire on the Sioux Ranger District.

The BCLMP action alternatives seek to increase fire resiliency throughout the BCLMP area by manipulating forest vegetation to create a spatial distribution of developmental classes and structure (tree size and spacing) and trend the existing vegetation condition class to Forest Plan desired vegetation characteristics across this landscape in accordance with the Forest Plan. Proposed techniques include a combination of mechanical and non-mechanical treatments such as thinning from below to remove ladder fuels (i.e. small trees and brush), large tree removal to increase crown spacing between residual trees, and prescriptive fire applications to reduce duff, needle litter and other biomass to a desirable level (See Forest Vegetation specialist report in the Project Record).

A. FUELS REGULATORY FRAMEWORK

Custer Forest Plan

Applicable fuels and fire related goals, objectives, standards, and direction identified in the CNF Management Plan as it pertains to the BCLMP are described below.

Forest wide Goals (USDA 1986, p 4):

- The goal of air resource management is to meet or exceed state air quality standards and ensure protection of air quality related values.

The BCLMP would meet this goal because all prescribed burning activities would continue to work within the scope of our open source-burning permit issued by the state and monitored by the Montana Idaho Airshed Group.

Forest Wide Objectives (USDA 1986, p.5):

- Air Quality of the National Forest System Lands will be maintained at or above levels required by Federal and State laws, regulations, and standards. The Forest Service will work with state and other Federal agencies to assure these standards are met.

The BCLMP would meet this goal because all prescribed burning activities would continue to work within the scope of our open source-burning permit issued by the state and monitored by the Montana Idaho Airshed Group. On a daily basis, a request is submitted via the Montana Idaho Airshed Groups website (http://www.smokemu.org/) and burns are either not approved or approval through this same web site.

- The management of the CNF insures a safe and legal environment for public use, as well as for cost-efficient fire protection and fuels management program that is responsive to the goals of the Forest, including cooperative efforts with other agencies and organizations.

By implementing the BCLMP, the post-treatment environment would provide a safer area for public use as well as improving the cost effectiveness of fire protection. This would be accomplished by decreasing the resistance to control and potential wildfire severity across the landscape.

Forest Wide Standards (USDA 1986, pp.21-39):

- Cooperating with Montana, North Dakota, and South Dakota Air Quality Bureaus in the Prevention of Significant Deterioration program and State Implementation Plans will protect air quality. Requirements of the PSD, SIP, and State of Montana, North Dakota, and South Dakota smoke management plans will be met whenever the FS has the authority to do what is required. The Forest will cooperate with states, other agencies, and organizations in identifying, evaluating, proposing solutions, and monitoring air quality problems associated with activities permitted on National Forest and National Grassland surface (USDA 1986, p 26).

- A combination of treatments will be used that will most efficiently meet the fuels management direction of each MA. The Forest will consider the use of prescribed fire, using both planned and unplanned ignition as a management tool. Unplanned ignitions may be used throughout the Forest to meet MA goals when proper fire prescriptions have been developed and approved by the Forest Supervisor. When prescribed fire-planned ignition is part of the treatment, it will be carried out at a time and within a prescription that will minimize impacts on air quality and soil damage, achieve the desired results, and conform to the Northern Region Fuel Management and Treatment Guides.

The PA is consistent with this Forest plan standard because treatments were designed with the most cost efficient method being used unless other circumstances prevent the use of a more

efficient method. All slash created would either be piled, yarded, or left on site before burning for disposal.

Management Area Direction (MA)

MA B:

- Wildfire Management
    - The control objective is to hold 90 percent of fire starts to less than 50 acres.
- Prescribed Fire

Planned ignitions may be used for range and wildlife enhancement, fuels and debris reduction. Unplanned ignitions will not be used as a management tool on the National Grasslands, but may be used on National Forest Districts to enhance range and wildlife values and to restore the natural fire frequency. Acceptance and use of unplanned ignitions will be with a plan approved by the Forest Supervisor. The fire management plan will address specific requirements of the site, weather, expected fire behavior, and fuel conditions necessary for declaring an unplanned ignition a prescribed fire. (USDA 1986, p. 47)

MA D:

- Wildfire Management
    - The control objective is to hold 90 percent of fire starts to less than 50 acres.
- Prescribed Fire

Planned ignitions may be used for range improvement and wildlife habitat, timber stand maintenance, fuels reduction, sanitation, maintaining vegetation, and associated wildlife habitat dependent on periodic fire. Unplanned ignitions will not be used as a management tool on the National Grasslands. Unplanned ignitions may be used as prescribed fire on National Forest Districts under an approved fire management plan. (USDA 1986, p.56)

MA F:

- Wildfire Management
    - The control objective is to hold 90 percent of fire starts to less than 10 acres.
- Prescribed Fire

Planned ignitions may be used for slash and debris disposal, enhancement of visual quality and preventative measures to reduce wildfire intensity. Unplanned ignitions will not be used as a management practice. (USDA 1986, pp. 62-63)

MA G:

- Wildfire Management
    - The control objective is to hold 90 percent of fire starts to less than 25 acres.
- Prescribed Fire

Planned ignitions may be used for timber stand maintenance and thinning, slash disposal, natural fuel reduction, wildlife habitat maintenance and enhancement with an approved prescribed fire plan. Unplanned ignitions may be used as a prescribed fire to meet management objectives under an approved fire management plan. (USDA 1986, p.65)

MA N:

- Wildfire Management
  - The control objective is to hold 90 percent of fire starts to less than 10 acres. Use minimal suppression equipment.
- Prescribed Fire

Planned ignitions may be used for wildlife habitat enhancement, and as a vegetative manipulation tool. Unplanned ignitions will not be used as a management tool specific to the management area. Wildfires entering these areas will receive an appropriate suppression response. (USDA 1986, p.84)

MA P:

- Wildfire Management
  - The control objective is to hold 90 percent of fire starts to less than 10 acres.
- Prescribed Fire

Planned ignition may be used for debris disposal and maintenance of administrative pastures. Unplanned ignitions will not be used as a management tool. (USDA 1986, p.88)

The BCLMP would meet the direction of all of the represented MA's and prescribed burning would be used appropriately in all MA's because:

1. *It is not likely, the treatments would prevent fire management personnel from meeting wildfire management control objectives and,*

2. *Prescribed burning would be used for manipulation of the fuels environment (fuel, debris, and potential fire intensity reduction (in MA-B, G, D, F, P) or as a vegetation manipulation tool (in MA-N woody draw bottoms).*

Custer National Forest Fire Management Plan

Applicable fire and fuels direction identified in the CNF Fire Management Plan (USDA 2009, Section III) as it pertains to the BCLMP area is described below.

Wildland Fire Management Goals, Objectives and Strategies

- Reduce wildland fire hazards in and near high value public and private property.

- Employ strategies to reduce risk of fire destroying or damaging cultural, historic or any private structure.
- Use a combination of mechanical hazardous fuels reduction practices and prescribed fire to reduce the intensity of unwanted fire near structures, cultural and historic sites.

This goal would be met in the BCLMP since accomplishment of proposed fuel treatments would reduce heat intensity from unplanned ignitions.

Wildland Fire Management

Prescribed fire will be used to maintain or restore plant communities, to cycle nutrients, to reduce or eliminate exotic plant pests, to maintain or improve rangelands for wildlife or livestock, and to reduce fire hazards. Prescribed fire is any fire ignited by management actions to meet specific objectives. A line officer approved plan is required prior to any planned ignition.

Prescribed burning would be used for manipulation of the fuels environment (fuel, debris, and potential fire intensity reduction or as a vegetation manipulation tool (in MA-N woody draw bottoms).

Non-Fire Applications

Mechanical treatments for fuels reduction will be used to modify wildland fuels to reduce the flammability and resistance to control. The mechanical reduction of fuels near structures and other developments is the preferred option for treating fuels. In many instances this treatment will precede an application of prescribed fire.

Non fire treatments most commonly used may include thinning, pruning, lop and scatter, hand or machine piling, chipping or mulching or removal as fuel wood by the general public.
The foremost outcome of mechanical treatment is the enhancement of fire fighter public safety and the protection of property and cultural sites. Reduction of fire suppression costs due to decreased severity and resistance to control will also be expected.

The BCLMP is consistent with this direction because we are not proposing anything outside what has been described.

Cohesive Strategy

This strategy is a national focus on maintaining and restoring healthy fire adapted ecosystems, by applying fire at appropriate intervals, intensities and time of year. Specifically on the Ashland RD ponderosa pine/grass is the ecosystem in the greatest need of restoration.

This is being followed because the NEPA process used in BCLMP would integrate specific concerns at a watershed or landscape scale for restoration of fire-adapted ecosystems.

Guidance for Implementation of Federal Wildland Fire Management Policy (February 2009)

- This guidance replaces the Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003). It consolidates and clarifies changes that have occurred since the 2003 strategy document was issued, and provides revised direction for consistent implementation of the Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001).

This guidance does not pertain specifically to the BCLMP treatments because this document provides broad direction for Fire Management and not project specific guidance, but is a consideration from a cumulative effects perspective with respect to unplanned ignitions.

B. FUELS EFFECTS ANALYSIS METHODOLOGY

Two major indicators were used to evaluate the changes in the fuels environment by alternative:

1. Risk of stand replacement fire – as measured by torching and crowning index
2. Fire Regime Condition Class (FRCC) – as measured by percentages of each vegetative structural development class within the project area

These two indicators were selected because they are a summation of fuel treatments that alter surface and canopy fuel characteristics, which influence fire behavior and the resulting short and long term effects on the landscape. Fuel Models were considered but it was noted that they are a representation of surface fuels not a representation of the total fuel situation that contributes to the fire behavior that may occur. Fire Behavior as measured by fireline intensity (flame lengths) was also considered, but it was noted that following fuel treatment, a fire may still exhibit moderate or even high flame lengths, but effects on the resources and ecosystem may not be detrimental or cause overstory mortality. An example is the more open pine stands with low surface fuel loading, in which the representative fire behavior fuel model generates flame lengths greater than four feet but the more open canopy results in limited mortality.

Risk of Stand Replacement Fire

The risk of a stand replacement fire was evaluated using the NEXUS Model (Scott 2004). Four variables are used in this model: surface fuel loading, canopy bulk density, canopy fuel loading and canopy base height. The model provides a set of minimum wind speeds necessary to initiate either single tree torching or sustaining a crown fire, i.e. risk of stand replacement burn. As with other crown fire models, NEXUS assumes that canopy base heights are consistent over time and space. This assumption within the model does not give consideration to regeneration coming in, damage from future natural events (such as wind and snow damage), or lower CBH from adjacent stands which may still allow surface fires to transition from a surface fire into a crown fire. In some wildland fuel types, surface fire alone can result in sufficient mortality to be considered a stand replacement fire; however in the ponderosa pine forests in the project area surface fires usually don't exhibit that behavior. Therefore, for this project, crown fire equates to stand replacement fire.

Four major fuel characteristics are used in modeling the likelihood of tree torching and sustaining an active crown fire: Surface fuel loading, Canopy bulk density, Crown volume and Canopy base height:

Surface Fuel Loading estimates were made from field visits in the BCLMP area in the summers of 2007 and 2008 using the photo series Black Hills Ponderosa Pine Type, 1990. These estimates were compared with values listed for fuel models that represent the project area. They were determined to be consistent. Fuel Models representing surface fuels for the project area is described in Section II – F; p. 3-66.

Canopy Bulk Density (CBD) is the mass of available fuel per unit crown volume (Scott and Reinhardt, 2001). This measure is the bulk property of an entire stand, not an individual tree. Canopy bulk densities values were obtained using the canopy cover estimates in Scott and Reinhart's (2005) photo guide.

Crown Volume estimates were made using Scott and Reinhart's (2005) photo guide.

Canopy base height (CBH) was estimated for the BCLMP area by ocular estimates gathered on site during visits on June 21-22 & 25-26, 2007, July 9-11 & 16-18, 2007 and November 17, 2008.

Fire Regime Condition Class

A FRCC assessment was completed for forested stands in the BCLMP area (68% of landscape). FRCC is a qualitative measure that describes:

1. The degree of departure from historical fire regimes, and
2. The degree of departure from historical vegetation structure distribution.

The departure may result in alterations of key ecosystem components, such as species composition, structural stage, stand age, canopy closure, and fuel loadings. Departure can be caused by any number of sources such as introduced exotic species, introduced insects or disease, and management activities. Depending on forest type, FRCC can be an indicator for fuel reduction needs and can help prioritize treatments to improve overall landscape condition class (Hann and Strohm, 2003).

The Black Hills PNVG (Potential Natural Vegetation Group) is commonly used to establish reference conditions for geographic areas that include Southern and Eastern Montana, Northern Wyoming, and Western North Dakota, and was used for a FRCC assessment of the BCLMP area. Based on the Black Hills PNVG, the historic fire return interval is approximately 15-35 years. In addition, Paul Sneed, Ph.D. conducted a fire history study on the Ashland Ranger District in 2005. Three core and fire scar sample sites were located within the BCLMP area. His research indicated fire return intervals in the BCLMP area ranged from 4 to 42 years, and narrowed to between 1 and 28 years when combined with the sites elsewhere on the Ashland Ranger District (Sneed, 2005).

The three FRCC's are adjectively described as low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime (Hann and Bunnell, 2001). The central tendency is a composition estimate of vegetation characteristics (species composition, structural stages, stand stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure (FRCC 1) is considered to be within the natural (historical) range of variability, while moderate and high departures are outside.

Ponderosa pine stand structure within this project area has not been affected by the limited past management activity or wildfire during the last 70 + years. At least two fire frequency intervals have been missed, therefore these stands are assessed FRCC 3. In summary, there is a high probability that key ecosystem components for Pine stands within this project area could be lost if there was a wildfire. A summary of the FRCC within the fire regime common for this area and an idea of management options are outlined in Figure 3.2.1.

Figure 3.2.1: Fire Regime Condition Class Description

Condition Class	Fire Regime	Example of Management Options
Condition Class 1 (Low)	Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.
Condition Class 2 (Moderate)	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). The result is moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as hand or mechanical treatments and fire use, to be restored to the historical fire regime.
Condition Class 3 (High)	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. The result is a dramatic change to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.	Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments, before fire can be used to restore the historical fire regime.

[1]Current conditions are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities

For additional information concerning the FRCC analysis, methodology, assumptions and calculations specific to the BCLMP area, refer to the Interagency FRCC Handbook version 1.2.0 (Hann et al., 2005), the DEIS Fuels Specialist Report - Appendix C, and FRCC Analysis FEIS, 01-19-2011 in the Project Record.

Fuel Model Correlation to FRCC Analysis Indicator

Fire behavior is the manner in which a fire reacts to available fuels, weather, and topography. Fuel characteristics affecting fire behavior include a variety of factors such as species composition, stand structure, fuel loading, and canopy characteristics, all of which may be characterized by a fuel model.

Fuel models (FM) are a set of parameters that define surface fuel characteristics that are inputs to the fire behavior spread model. Fuel models are used to characterize the main fuel type (i.e. grass, brush, timber, litter, or logging slash) that drives the behavior of a surface fire.

Fuel Models represented in the BCLMP areas were classified by site visits and referencing *Aids to Determining Fuel Models for Estimating Fire Behavior* (Anderson, 1982). The existing condition was compared to a historic condition from a FRCC assessment that used the Black Hills PNVG. The structural classes and fuel model associated with each class found in the BCLMP are:

- Early Development Stands- Most often modeled as Fuel Model 2-Timber (grass and under story). Will also include Fuel Model 1 – short grass.

- Mid Development/Closed Canopy Stands- Most often modeled as Fuel Model 9- Long needle pine litter.

- Mid-Development/Open Canopy Stands- Most often modeled as Fuel Model 2- Timber (grass and under story).

- Late Development/Open Canopy Stands- The main fire carrier would be grass, making this a Fuel Model 2- Timber (grass and under story).

- Late Development/Closed Canopy Stands- Because the main carrier in these stands is ponderosa needles, the most representative Fuel Model is 9- Long needle pine litter.

Complete descriptions of these structural classes and the fuel models associated with each structural class can be found in the DEIS Fuels Specialist Report - Appendix A in the Project Record.

C. SPATIAL & TEMPORAL BOUNDS USED FOR FUELS EFFECTS ANALYSIS

Unless otherwise stated, the geographic area used to analyze the effects to the fuels environment is the BCLMP Area. The BCLMP area was selected because 1) it provides a scale large enough to assess effects, 2) there is sufficient data, and 3) treatments that occur inside the BCLMP area would not affect the fire hazard elements (crown fire potential, structural diversity, and firefighter safety) outside the BCLMP area. This spatial boundary can also be found in Appendix A- Map 26. (The Ashland Ranger District is the area used when discussing cumulative effects.)

In determining the temporal bounds of this analysis, consideration was given to the ecological development of this landscape. There is no doubt dry ponderosa pine types developed over time with fire as the main disturbance agent. As previously mentioned, local data suggests the fire return interval for the BCLMP area may be 4 to 42 years long.

If a temporal bound were chosen on the low side of this interval, treatment effectiveness would likely be over-estimated because treatments would not likely to have developed much by the next disturbance event. However, if an interval near the upper end of this estimate were used, treatment effectiveness would likely be underestimated, as stands would likely develop beyond the desired condition. Therefore, it seems reasonable a value somewhere in the middle would minimize both over and underestimation of the proposed treatment alternatives. For the purpose of the fuels analysis, 25 years was selected as the temporal bounds.

II. AFFECTED ENVIRONMENT FOR FUELS

A. WIND

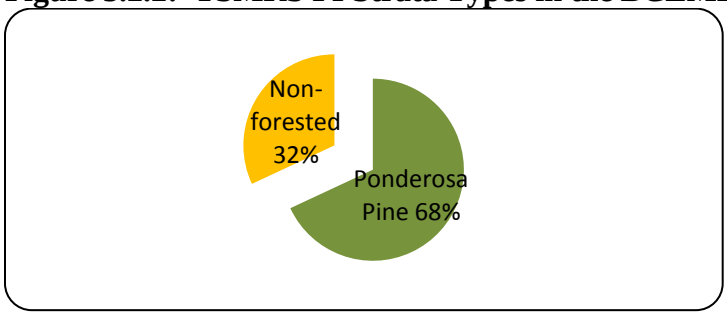
The prevailing winds in the BCLMP area generally come from the southwest, causing fire spread and general fire movement to the northeast. Strong winds are generally associated with cold fronts and thunderstorms, which can have an effect on fire behavior due to shifts in wind direction and downdrafts. The past nineteen years of Remote Automated Weather Station (RAWS) data from two area stations was used to determine the wind profile for the BCLMP. Average peak sustained wind speed and average peak wind-gust speed was determined for the fire season months of May through October. These wind variables were chosen to represent afternoon winds and thunderstorm gusts when most unplanned ignitions occur. Average peak sustained wind speed was 17 mph (highest recorded observation was 30 mph). The average peak wind-gust speed was 33 mph (highest recorded observation was 56 mph).

B. SPECIES COMPOSITION

The BCLMP area contains three types of ecosystems: ponderosa pine forests, hardwood bottoms, and grasslands with trees (non-forested). TSMRS (Timber Stand Management Record System) photo interpreted (PI) data and stratum data was used to classify ecosystem types in the BCLMP area. Approximately 68% (9,585 acres) of the BCLMP area is comprised of ponderosa pine

forested stands, and 32% (4,467 acres) is non-forested grasslands. Hardwood bottoms constitute less than 0.1% of the project area and were combined with the ponderosa pine forest type for purposes of this analysis. See Figure 3.2.2. Additional information on data limitations and species composition in the BCLMP area is available for review in the Forest Vegetation Specialist Report in the Project Record.

Figure 3.2.2: TSMRS PI Strata Types in the BCLMP Area



C. STAND STRUCTURE AND FRCC

As depicted above, approximately 68% of the BCLMP area is classified as forested ponderosa pine stands. TSMRS (Timber Stand Management Record System) data was used to classify stand structure within the five PNVG structural classes, including post replacement, mid development closed, mid development open, late development open, and late development closed, as shown in Table 3.2.1. (Refer also to the DEIS Fuels Specialist Report - Appendix C, FRCC Assessment, and Handbook Reference Conditions in the project record).

Historically, all of these structures existed across the landscape at some level. The existing stand structure was compared to a historic reference stand condition by utilizing the Black Hills PNVG[1]. The Black Hills PNVG provides a reference value for fire frequency, fire severity, and vegetative structure (see DEIS Fuels Specialist Report in the project record). The departure from historic to existing stand conditions is shown in Table 3.2.1 and Figure 3.2.3. and 3.2.4.

Table 3.2.1: Vegetative Departure from Historic Reference Levels for the BCLMP Area

Structural Class	Percent - Existing Condition	Percent - Reference (Black Hills PNVG)	Percent Departure
Post Replacement	1%	10%	-82%
Mid Development Closed	2%	15%	-76%
Mid Development Open	2%	25%	-85%
Late Development Open	20%	40%	-33%
Late Development Closed	75%	10%	76%

[1] Rationale for the use of the Black Hills PNVG has been included in DEIS Fuels Specialist Report Appendix C – Fire Regime Condition Class (see Project Record).

Figure 3.2.3: Beaver Creek Historical Vegetative Structural Class Distribution

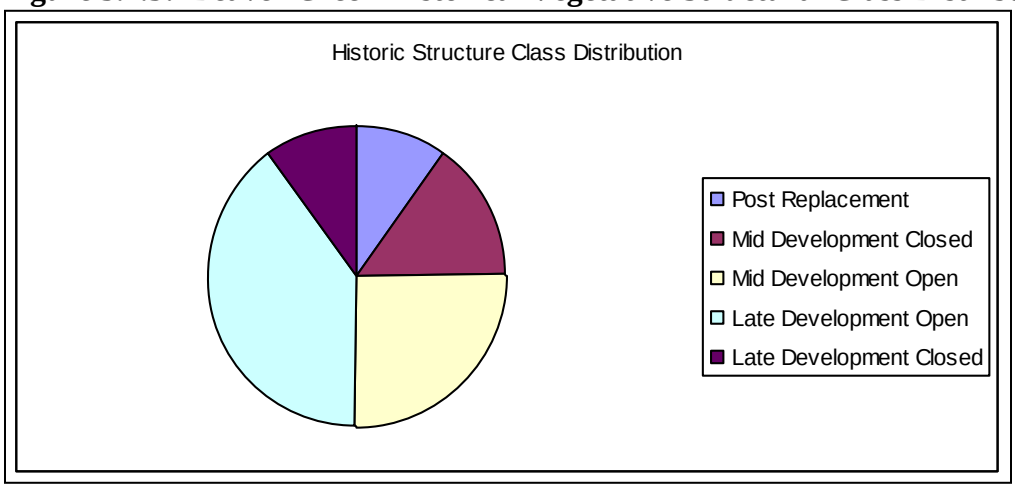
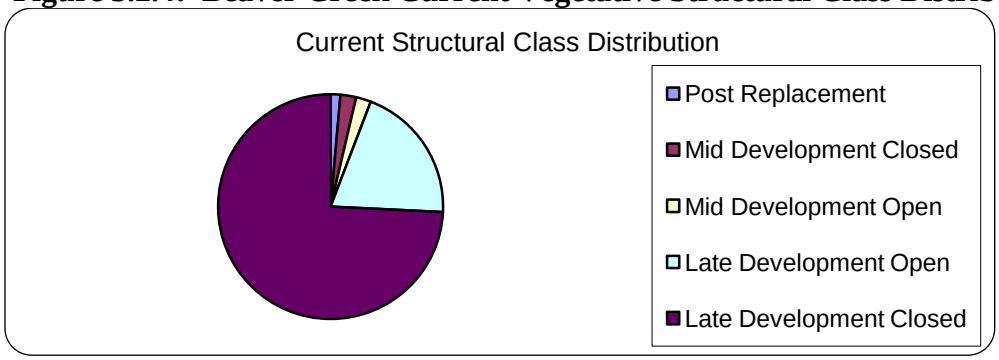


Figure 3.2.4: Beaver Creek Current Vegetative Structural Class Distribution



Stands identified for treatment in this project have canopy closure greater than 40% with most being near 70%, which equates to *vegetative structure* FRCC 3. The FRCC departure from historic *fire regimes* for forested areas in the BCLMP area (i.e. the majority of this area has been lacking a fire for over 68 years) elevates the existing FRCC rating to Fire Regime Condition Class 3, which is a high departure from historic (reference) conditions and further verifies the FRCC rating for all stands to be treated. A wildfire in these stands is likely to be a crown sustaining fire, resulting in high severity and large-scale overstory mortality. (The stand strata in a more open canopy structure was the result of past management activities but also has not been influenced by fire for over 68 years. They are in FRCC 2.)

D. SURFACE FUEL LOADING

Surface fuel loads, including fine fuels and coarse-woody debris, vary throughout the BCLMP area. Fine fuels are relatively continuous throughout the BCLMP area, in the form of twigs, small branches, live and dead brush and grasses, and pine needles. These fine materials contribute to the overall fire spread, especially on the sites where the forest floor is littered with ponderosa pine needles. Observations of past fire behavior shows that small woody material, less than 3" in diameter, has the most substantial influence on fire behavior (such as spread rates

and fire intensity), and can be estimated using broadly accepted fire behavior models (Brown, Reinhardt, Kramer 2003).

As documented in site visits, the BCLMP area currently contains fuels in the 0-3"+ category that average 5-8 tons/acre, with some stands experiencing loadings as high as 15+ tons/acre (Hammer, 2006, Anderson, 2008). Stands with fuel loads in excess of 15+ tons per acre are scattered across the BCLMP area in areas with greater than 40% canopy cover. Heavy snow events in the spring of 2007 fall of 2008, and spring of 2009 broke off the tops of some mature sized trees, creating Coarse-woody debris (CWD), and increasing surface fuel loading. In the short term these fuels initially act as a heat sink, where the longer these fuels are left untreated the more they become available to burn. Best available data suggests that surface fuel loading historically was fairly light at 5-7 tons per acre on the Ashland RD (Sandbak 2004).

Coarse-woody debris (CWD) includes dead standing and downed pieces greater than 3" in diameter. Decay rates for dead, down woody material are generally lower on dry sites than on moister sites, especially in the absence of fire (Brown, Reinhardt, and Kramer 2003). Crowning out, spotting, and torching are greater where heavy CWD has built-up in a forested environment and can contribute to large fire development and high fire severity. (Brown, Reinhardt, Kramer 2003).

E. CANOPY CHARACTERISTICS

Canopy Base Height (CBH) is the lowest height above the ground at which there is sufficient amount of canopy fuel to propagate fire vertically into the canopy (Scott and Reinhardt, 2001). When a reduction of crown fire initiation is a priority, fuels treatments should include removing some or all of the ladder fuels and other vegetation that contributes to a low canopy base height.

In the BCLMP area, canopy base heights are less than 16 feet and often as low as five feet. In the absence of some form of fire, regeneration is allowed to establish. Thickets of regeneration are easily seen across the BCLMP area, containing stocking rates in excess of 1000 trees per acre. Furthermore, as mentioned in the fuel loading section, events such as winter storms can also contribute to a decreased CBH. This is primarily due to the increase in snow damaged trees and tops that have broken off, providing a "ladder" of available fuel to the main canopy.

Canopy Bulk Density (CBD) is the mass of available fuel per unit crown volume (Scott and Reinhardt, 2001). This measure is the bulk property of an entire stand, not an individual tree. CBD is a representation of canopy closure. Canopy bulk density values were obtained using the canopy cover estimates in Scott and Reinhart's (2005) photo guide. Although variations in CBD may be a result of the differences in site productivity, this guide provides the best information available to estimate CBD levels. The CBD values used correspond to canopy closures of 23-69% (Reference DEIS Fuels Specialist Report - Appendix B in the Project Record).

Scott and Reinhardt (2001) describe the criteria necessary for active crown fire as: "Mass-flow" rate. It was defined by Van Wagner (1977) as the rate of fuel consumption (kg m-2 s-1) through a vertical plane, oriented parallel with the fireline within the fuel bed. It is the product of spread rate (m s-1) and fuel bed bulk density (kg m-3). Fuel or canopy bulk density affects the critical

spread rate needed to sustain active crown fire. If the mass-flow rate falls below a certain threshold, active crowning is not possible. Therefore, the lower the CBD, the lower the potential for active crown fire. This increases the crowning index – or wind speed at which active crown fire is possible**.** Simply put, it takes greater winds to sustain active crown fire once the canopy bulk density is decreased in a stand. It is assumed that treatments that remove overstory trees would also effectively lower the CBD – for example, if 50% of the canopy is removed, it is assumed the canopy bulk density is decreased by 50% on average. However, this relationship can vary depending on species removal, as some species have more mass in the canopy than others.

F. FIRE BEHAVIOR

Surface Fire Behavior

Fire behavior in the surface fuels is often expressed in terms of flame length and rate of spread. Using the most representative fuel model(s) for the site with either the seasonal average or current fire weather parameters for the day generates these two outputs. An array of fuel models has been developed representing surface fuel characteristics for conifer and hardwood stands throughout the U.S. (Anderson, 1982). Most representative fuel models for the surface fuels found with the timber stands in the project area are:

Fuel Model 1, short grass and Fuel Model 2, timber with grass understory (23% of project area): Surface fires would exhibit behavior that would limit direct attack to ground machinery and aerial resources. The expected flame lengths of 8-12 feet is greater than the limit suggested by the Fireline Handbook (NWCG, 2006) to be safely attacked by hand crews using direct attack methods. While these are fast moving fires, their intensities are often less than fuel models with timber litter as the primary carrier. Although overall fuel loading is generally less in these stands, they are more open to the elements such as solar radiation and drying of fuels due to the generally west to south aspects.

Fuel Model 9, long needle pine litter (77% of project area): Surface fires would exhibit behavior that would be expected to produce 4-foot flame lengths. This would allow hand crews to attack the wildfire using direct attack. However, this assumes that the fire would remain a surface fire. Spotting and torching are more likely in this fuel type because of the associated fuel ladder that can be easily ignited by the four-foot flame lengths. This leads to the potential for increased heat intensity and fire spread into the overstory canopy fuels.

Crown Fire Potential/Risk

Crown fire potential is generally based on the amount of surface fuels, existence of ladder fuels, and the density and spacing of the overstory. Heavy surface fuels generally contribute to longer flame lengths. If canopy base heights are low, surface flames can easily spread fire into the tree crowns. Once there, a crown fire would likely persist if the canopy structure is dense. Dense canopies require much less wind speed to support crown fire compared to open canopy stands.

Throughout the BCLMP a majority of stands have dense closed canopies, a well develop fuel ladder layer and varying surface fuel loadings. These high risk stands are represented by the

Mid-Development Closed and Late-Development Closed stand structures. These classes make up 77% of the Project area.

Crown Fire Modeling (Torching & Crowning Indices)

Crown Fire potential was evaluated for the various structural development classes using the NEXUS model. Mid-Development and Late-Development Closed classes are represented by 69% canopy closure, 5-foot canopy base height, and average surface fuel loading. Values generated by the model indicate a 20-foot wind speed of 15.5 mph would be sufficient to initiate tree torching and a wind speed of only 13.9 mph would sustain an active crown fire. These are common daily wind speeds for the Ashland RD. Torching usually causes spotting, additional ignitions as well as serves as the 'ignition source' for the crown fuel layer. This is the first stage for development of a crown fire that would continue or 'fall back' to the surface depending on the wind at the canopy layer or density of the canopy, i.e. canopy closure percent. (Reference Table 3.2.2 NEXUS Torching and Crowning Fire Indices)

Table 3.2.2: NEXUS Torching and Crown Fire Indices

Canopy Cover	Canopy Base Height	Surface Fuels	20 – Foot Wind Speed to Initiate Torching	20 – Foot Wind Speed to Sustain Crown an Active Crown Fire
69%	5	Average	15.5	11.9
69%	16	Average	47.5	11.9
52%	20	Average	58.1	13.2
47%	23	Average	65.8	17.6
35%	27	Average	75.8	21.2
23%	30	Average	19.6	26.4

A moderate - closed stand canopy (40 % or more) with a moderate to low level fuel ladder layer needs light wind speeds to initiate tree torching and/or sustain a crown spreading fire. Stronger winds are necessary for more open stand (35 percent canopy closure or less) with little or no fuel ladder. Treatments that reduce the canopy cover to less than 40%, maintain surface fuels loading at 2-7 tons per acre, and increase the canopy base height to at least 16 feet would be the most effective at reducing the potential for torching and stand replacement fire. (Note Table 2.4: Acres of Proposed Treatment by Alternative, Chapter 2).

The NEXUS Modeling Program supports the scenario that untreated stands above 40 % canopy closure and low canopy base heights only need light winds within the stand to initiate tree torching and sustain an active crown fire. Winds within a stand are regarded as eye-level or mid-level winds. Mid-level winds of 4.5 mph (15 mph 20 foot wind) within forested stands on the Ashland Ranger District are common throughout the fire season.

When CBH is raised to 16-20 feet, eye-level wind speed needed to initiate torching behavior is almost doubled. But what is significant is that the wind speed needed to sustain a crown fire remains almost the same unless canopy cover percent is reduced. Rationale is that there is very little obstruction on wind speeds once the fire is in the crown layer. Winds within the stand help dissipate the convective heat from the surface fuels across/through the foliage layer facilitating a

pre-drying and pre-heating of adjacent foliage. The stage is set for a continuing sustained crown fire. See Table 3.2.7 and effects analysis for comparisons and more information.

III. EFFECTS COMMON TO ALL ACTION ALTERNATIVES FOR FIRE/FUELS

A. FUEL ACCUMULATION

Regardless of the alternative chosen, fluctuations in fuel loading would continue indefinitely in the BCLMP area as stands progress through succession. The 'action alternatives' (A, B and C) would reduce fuels in the near-term and subsequent prescribed fire entries would be needed to maintain post-treatment fuel loadings and stand structure. Past history on the Ashland RD indicates that a maintenance burn should be implemented on a 10 – 15 year cycle to keep the fuel situation and stand structure within historic reference levels for the fire regime of this area. Maintenance burns are proposed under Alternative B and C.

B. UNPLANNED IGNITION

Lightning is the main cause of fire occurrence on National Forest System lands on the Ashland RD. According to the Ashland District Fire Summary, the Ashland District of the Custer National Forest has more lightning caused fires per acre per year than any of the other Districts on the Custer. From 1951-1988, 1360 fires or an average of more than 36 fires per year were reported (Clark's Report, 1989). Regardless of the alternative selected, ignitions would still be expected across the BCLMP area.

Success with initial attack relies on efficient arrival time to a fire. Well-maintained roads allow for safer travel and a variety of tactics to manage the fire. Although road maintenance would be necessary to accomplish treatment alternatives, no new permanent roads are proposed for this project. More open canopy stands with reduced surface and ladder fuels allows for use of more tactical methods, as well as quicker and safer foot travel to/from wildfires not accessible by an engine or other vehicle.

Wildfire management response with resource benefit objectives has not been used on the Ashland RD. However in 2009, an Appropriate Fire Management Response document for the district was adopted and is included as an appendix to the Custer Forest Fire Management Plan. In the future, management response for unplanned ignitions would include this option. Implementation of fuel treatments in the action alternatives would restore some resiliency (less in Alternative C than A or B) to ponderosa pine stands, which could result in unplanned ignitions meeting prescription criteria in the guidebook and being used as a management tool.

C. GREATER THAN 40 ACRE OPENINGS

As vegetation develops across the landscape, stands form with similar composition and structure. Wildland fuels common to these stands promote similar expected fire behavior. Fuel treatments are intended to manage the total fuel situation, i.e. surface, mid layer ladder, and canopy layer

fuels, to accomplish the goals of the project. The proposal to treat and manage the total fuel situation may exceed human based guidelines such as Regional direction for openings greater than 40 acres.

Fire behavior depends on fuel continuity, current weather and topography. A fuel situation across the landscape that is contiguous either in kind or amount is problematic both for suppression efforts and potential for a large-scale wildfire. The importance of fuel continuity across the landscape is better realized by assessing relative different scenarios. A heterogeneous landscape provides opportunities for firefighters to make safe, reasonable, strategic and tactical decisions in managing a fire. For example, reducing fuels in a 1-acre checkerboard across the landscape would have less of an effect than strategically placed zones of lesser fuel loads, even if the same number of total acres were treated (Agee 1996; Finney, et al 2001).

Areas with fuel situations resulting in less intense wildfires act as "barrier or buffers" to interrupt an advancing wildfire. Fire spread drops from the canopies and becomes more a ground spreading fire, which provides fire suppression forces more of an opportunity to contain the fire. Even in the case of a spotting wildfire, spots lofted into more open areas with less fuels would remain as low heat intensity ground spreading fire for a period of time which can more easily be contained by suppression forces.

BCLMP post treatment stands in the Northern goshawk post fledgling family areas (PFAs) on the east side of the project area would still have a canopy closure greater than 40-50% which indicates these stands are vulnerable to crown fire spread should one advance from the west or be initiated by a lofting spot. The designated Big Game Security Area adjacent to the northern boundary of the BCLMP is untreated and contains stands with high potential for crown fire movement, spotting, erratic behavior and probable large scale stand replacement burn. Wind patterns common to this area of the Ashland District average 8 – 12 mph from the west-southwest during the fire season. The location of the proposed openings greater than 40 acres in the central and northeast portion of the project area, in conjunction with interspersed natural non-timbered or low fuel loading areas to the west, and scattered treatment units that create openings less than 40 acres throughout the project area creates a diverse, heterogeneous fuel situation more defensible in providing fire protection for the PFA, wildlife security areas, and adjacent private property.

The location of units that create openings greater than 40 acres was limited by previous designated special areas with restricted resource criteria, i.e. PFA's and wildlife security cover. There are stands in both of these special areas where similar treatment prescriptions would enhance the more desired and defensible heterogeneous fuel situation for the landscape.

The treatment units that create openings larger than 40 acres, in conjunctions with other treated units, and the existing natural non-timbered lands help advance the landscape for this portion of the Ashland District toward the historic distribution of forest age classes and structure.

D. PRESCRIBED FIRE MAINTENANCE

Re-occurring prescribed maintenance underburns would be needed in order to ensure long-term fire protection for private lands, special designated resource areas and to maintain a distribution of forest age/stand structure that is more resilient against high-severity stand replacing wildland fires. These underburns should be considered every 10 – 15 years, and could be considered in the future subject to additional NEPA analysis. Burning prescription would be a low heat intensity fire with flame lengths not exceeding 2-3 feet and spreading over 70-80% of the stand area. The end-result would be a patchy mosaic of burned and unburned areas resembling the historic natural balance of this ecosystem. Some patches of newly established regeneration may survive, which coincides with the historic natural age class distribution. Some portions of the stand would be left more open. Fire spread would not occur where ground fuels are still sparse or discontinuous. If a heavy fuel accumulation occurred over an extensive area since the last prescribed fire entry, these concentrations may need to be burned prior to the underburn. Unexpected fuel loadings are common in this area due to such natural events as snow and windstorms.

Specific objectives for a maintenance underburn program is threefold: (a) lessen amount of 0-3 inch diameter surface fuels that accumulated since the last treatment (b) ensure mortality of some regeneration that established and created fuel ladder situation, and (c), stimulate sprouting of hardwoods/aspen in draws and other desired locations.

IV. EFFECTS OF ALTERNATIVE A ON FUELS - PROPOSED ACTION

A. DIRECT & INDIRECT EFFECTS OF PROPOSED ACTION ALTERNATIVE ON FUELS

For the purpose of this effects analysis, the proposed treatments were classified into five broad categories: 1) commercial thin, 2) commercial thin/regeneration, 3) noncommercial, 4) post replacement (commercial and noncommercial) and 5) commercial thin/wildlife. See Table 3.2.3 below.

Table 3.2.3: BCLMP Fuels Analysis Treatment Categories.

Treatment Category	Treatments
Commercial Thin	CT, SC
Commercial Thin – Regeneration	ST1, SH1
Non Commercial & Pres. Burn	NC4, NC5, NC1, NC2, NC3, RXB, SCNC
Post Replacement (Commercial/Noncommercial)	LIB, PCT, STR, STR1
Commercial Thin - Wildlife	CT1

These categories were selected based on similar post treatment stand conditions resulting from the different prescribed treatments. The end result structures and fuel characteristics within each category coincide with the project objectives (Table 3.2.3). Treatments in these categories primarily target three main fuel characteristics:

- Surface fuel loading,
- Ladder fuels, and
- Canopy fuels.

Treating these three fuel characteristics effects fire behavior and has a corresponding relationship with the two analysis indicators (1) stand replacement potential/risk and (2) fire regime condition class. The amount of stands treated (acres) would vary by alternative, and is summarized in Table 3.2.4.

Table 3.2.4: Acres Treated Comparison Between Alternatives

Treatment Categories	Acres Treated Alt. A	Acres Treated Alt. B	Acres Treated Alt. C
Commercial Thin	242	185	156
Commercial Thin/Regen	1027	905	703
Non Commercial	7694	7902	7123
Post Replacement	278	278	78
Commercial Thin/Wildlife	1267	1238	0
No Treatment	3545	3545	5993

Overall, treatments identified in Alternative A would reduce the potential for stand replacement wildfire over a majority of the project area. This is primarily the result of treatments in the Commercial, Commercial Thin/Regeneration and Noncommercial categories.

Post treatment conditions in the commercial thin and regeneration stands would require a wind speed greater than normally occurs throughout the fire season to initiate torching (83 mph) and sustain a crown fire (31 mph). Refer to Table 3.2.5 for treatment comparison of Torching and Crowing Index. Treatments in these categories target fuel layers responsible for a surface fire spreading into crown fuels. Although there is some reduction in the surface fuels, the primary fuel layers are the ladder and crown canopy fuels, as measured by crown base heights (the height above the ground surface where branching for crown fuels begin) and percentage of crown cover.

Post treatment conditions for noncommercial treatment would reduce stand replacement potential. Modeling indicates that it would take a 47 mph wind to initiate torching which is

above the 33 mph peak wind-gust speed, and a 24 mph wind to sustain an active crown fire which is above the 17 mph average peak sustained wind speed for the area.

Post treatment conditions for stands in the Commercial Thin/Wildlife category show a moderate resiliency to stand replacement fire compared to no action. These stands require an increased wind speed to initiate torching (36 mph) which is just above the 33 mph peak wind-gust speed, but an active crown fire could be sustained with a 15 mph wind should an ignition reach the crown fuels (17 mph peak wind speeds are average for the project area). This is primarily because the average crown base height is at or below 15 feet and canopy closer is at or greater than 40 percent (See Table 3.2.5).

Post treatment conditions for stands in the Post Replacement category show some resiliency to stand replacement fire compared to no action. These stands require an increased wind speed to initiate torching (31 mph), which is close to the peak wind-gust speed, however an active crown fire could be sustained with a 15 mph wind. Again, this is primarily because the average crown base height is below 15 feet (See Table 3.2.5).

Commercial Thin Category Treatments: CT, SC

Commercial activities would start soon after the decision is signed. Preparation and implementation of the initial phase of the Proposed Action may take from one to five years to complete. Post treatment stands would resemble mid or late strata development, fairly open stands with canopy closure in the range of 20 – 30%. There are limited ladder fuels with a crown base height averaging 20-30 feet. Surface woody fuel loading would range between 3-7 ton/acre, of which 0-3 inch diameter would not exceed 3 tons/acre, and 3-12 inch plus diameter, is a minimum of 3 tons/acre (with 50% being 12" and larger when available). Various options would be available to treat surface fuel to the desired levels, including prescribed fire.

Reducing stand replacement wildfire potential would be achieved on 243 acres. Included in these treated units are 27 acres without prescribed underburning. These units exclude prescribed burning because the surface fuel loading is assessed to be at a level in which burning poses a high risk of exceeding acceptable overstory morality. However, this mortality increase is not expected to exceed the fire created overstory tree mortality limits' identified in the Forest Vegetation Specialist Report. This would need to be assessed at the time of developing the prescribed burn plan.

In units where burning will not be done, either biomass utilization, mechanical slashing, grapple or hand pile and burn would be necessary to bring surface fuel loadings to a level that helps lessen stand replacement potential. These treatment methods are higher cost and effective, but not as effective as prescribed fire in reducing the fine fuel loading (the smallest branch wood material.)

Generally, prescribed burning in a sale area would not occur until the commercial operation is complete, unless it can be implemented without impacting the operation. Prior to prescribed burn activity, a prescribed burning specialist and/or forester would monitor the effects of the harvest treatment on the overall fuel situation and determine the prescription for the prescribed fire. Monitoring fuel moistures and weather is standard procedure to determine the appropriate

time to burn. Due to the variability in weather conditions, prescribed fire treatments could take up to a year to complete. Timing of the burn would be adjusted to meet treatment objectives.

Prescribed burns would be implemented within acceptable overstory mortality objectives and to meet surface fuel levels identified in the silvicultural prescriptions (Appendix B). Where whole tree yarding is the initial entry, prescribed under burning may not be needed over the entire unit in order to meet desired surface fuel levels.

Because existing stand conditions have developed without natural fire for a long period of time, a multiple entry approach may be used with all treatments. This 'two-stage' entry is especially true with prescribed under burning in order to manage heat intensity, fire spread and be within acceptable residual stand mortality objectives. The first prescribed fire entry would primarily be for disposal of piled and/or concentrated fuels. Some spread or "managed creep" beyond the piled/concentrated area is still likely depending on project constraints. The second prescribed fire entry would be an objective of a more extensive low heat intensity surface spreading fire throughout at least 70 – 80 % of the stand.

Commercial Thin--Regeneration Category Treatments: ST1, SH1

Post treatment stands would resemble mid open to late open development. The stands would be more open than the previous category with canopy closure in ST1 units in the range of 5 – 15% and 15 – 25% in SH1 treated units. Reducing stand replacement wildfire potential would be achieved on 1027 acres. Included in these treated units are 194 acres without prescribed underburning. Several units treated in this category would exceed 40 acres in size.

All other specifics regarding surface fuels and prescribed burning discussed in the previous category are applicable for this category.

Non-Commercial Category Treatments: NC4, NC5, NC1, NC2, NC3, RXB, SCNC

Post treatment stands would resemble mid or late open strata development having a fairly open canopy closure ranging from 10 – 40 % with some units being closer to 50%. Nearly 83% of the treated units in this category would resemble late-open development class but with a diverse understory. Crown base height average 15-20 feet.

Fuel treatments in this category would have a positive effect in reducing stand replacement fire potential for 7,123 acres. Within these treated units there are 366 acres where prescribed underburning will not be done. In these units either some mechanical or pile and burn fuel treatment would be used in reducing surface fuel loadings to the prescription levels. With the more open canopy spacing and limited ladder fuels the increased surface fuel loading following the initial harvesting and/or thinning activity, is now assessed as being a short-term impact.

Post Replacement Category Treatments: LIB, PCT, STR, STR1

Post treatment would closely resemble mid to late development open canopy stands, with limited ladder fuels and lower stocking densities. Canopy closure would be near 40% and a crown base

height averaging 10 feet. Surface woody fuel loading would be at upper end of 3 – 7 ton/acre, of which 0-3 inch diameter would not exceed 3 tons/acre, and 3-12 inch plus diameter is a minimum of 3 tons/acre (with 50% being 12" and larger when available).

Some reduction in potential stand replacement fire would be achieved on a majority of the 276 acres. Since some units are located within PFA boundaries, 198 acres would not include prescribed under burning or jackpot burning. Surface fuel loading following the initial thinning activity are assessed to be at a level in which burning poses a high risk of exceeding acceptable morality in adjacent stands (see Chapter 2, Table 2.8). However, this mortality increase is not expected to exceed the fire created overstory tree mortality limits' identified in Chapter 2, Table 2.8.

Treatments would improve canopy spacing although it would be at the threshold value that could support some crown fire if ignited. Ladder fuels would be lessening to a level that would not support vertical fire movement from the surface. Surface fuel loading would be increased slightly but not exceed the upper 7 ton/acre prescription. Until treated to the prescription range, surface fuel loads would pose a short-term risk. In these areas where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Commercial Thin/Wildlife Category Treatments: CT1

Treated stands would resemble a late development closed canopy appearance with limited ladder fuels and areas of higher stocking densities to promote high canopy coverage to maintain goshawk habitat over the long term. The CT1 treatment maintains a 50 % canopy cover and a crown base height of 15 feet. Surface fuel loading would be 3-7 tons acres with approximately 50% identified as Coarse Woody Debris (CWD) for long-term soil productivity, i.e. large diameter size material. Fuel treatments in this category would not include prescribed burning, because surface fuel loading are assessed to be at a level in which burning poses a high risk of exceeding acceptable morality. (See Chapter 2, Table 2.8). Since prescribed burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to meet surface fuel loading levels identified in the prescription.

Following treatment approximately 1,267 acres would pose a moderate resiliency against a stand replacement wildfire. **Average fire weather conditions have an average 20-ft wind speed of 17 mph. Post treatment, it would take a 36 mph wind to initiate torching, but only a 15 mph wind to sustain an active crown fire in the CT1 stands** (see Table 3.2.5 below). The potential for a stand replacement burn still exists even without an extreme weather event. This potential is a combination of surface fuel loading near the upper end of 5 – 7 tons acre, scattered areas where the residual understory could still act as ladder fuels and an overstory canopy closure near 50%. This effect is a reflection of the denser canopy. Reference Canopy Base Height of 16 feet and Canopy Closure of 52% values noted Table 3.2.4 for the Wildlife Category. The benefit of treatment is that it takes a higher wind speed to initiate torching compared to no action (36 mph when the average wind is 17 mph).

Torching and Crowning Risk Indicator for Alternative A

The NEXUS Modeling Program supports the scenario that untreated stands above 50 % canopy closure and low canopy base heights can experience tree torching and a sustained crown fire from winds that are common throughout the fire season. Note that a 15.5 mph wind would be adequate to initiate torching and even a slightly less wind speed (13.9 mph) would likely sustain an active crown fire (Table 3.2.5.). Both wind speeds are below the seasonal average, meaning there is a high probability that wind on most days throughout the fire season are sufficient to initiate torching and definitely sustain an active crown fire should there be an ignition. The average peak 20-foot wind speeds during the fire season are 17 mph. A 20-foot wind speed of 15 mph converts to an eye-level or mid-level wind speed of 4 mph within the forested stands. This has been verified by site visits and is a common event on the Ashland Ranger District throughout the fire season.

Table 3.2.5: Alternative A: NEXUS Post Treatment Results and Acres by Treatment Category

Treatment Categories	Acres Treated Alt. A	Canopy Cover	Canopy Base Height	20 – Foot Wind Speed to Initiate Torching (Torching Index)	20 – Foot Wind Speed to Sustain Active Crown Fire (Crowning Index)
Commercial Thin	242	23%	30	83.2	31.2
Commercial Thin/Regen	1027	23%	30	83.2	31.6
Non Commercial	7694	35%	16	47.5	24.4
Comm. Thin Wildlife	1267	52%	12	36.6	15.4
Post Replacement	278	52%	10	30.9	15.4
No Treatment	3545	69%	5	15.5	13.9

When the CBH is raised to 10-20 feet, wind speeds much greater than the seasonal average are needed to initiate torching (30 mph plus). What is significant is that the wind speed needed to sustain a crown fire is still within the average fire season weather parameters, should an ignition occur within the crown fuels. Rationale is that there is very little obstruction on higher-level wind speeds once the fire is in the crown layer. This further stresses the importance that treatment of both ladder fuels (as indicated by crown base height) and canopy fuels (as indicated by canopy cover) should be treated to lessen potential for stand replacement fires. Note the effect with a treatment that raises CBH to 16 feet and reduces canopy closure to less than 40%. (Table 3.2.5.) A more open crown canopy permits 'venting' of some heat from a fire burning in the surface fuels. Otherwise convective heat from the surface fire facilitates pre-drying and pre-heating of the overstory fuels/canopy. The stage is set for a more susceptible fuel layer to initiate torching. This could happen when scattered concentrations of heavier surface fuel loading ignite and flare up, or there is a significant increase of winds.

The model indicates that torching appears to have been significantly reduced in all treated stands. Treated stands in the commercial and non-commercial categories also show a high resiliency

against a sustaining crown fire. This is primarily because of a crown base height of at least 20 feet and canopy closures less than 40%. Although crown base heights appear to be adequate to warrant against torching in the post replacement and wildlife categories, these stands remain vulnerable for a sustaining crown fire if the crown fuel are ignited. Crown base heights are lower and the canopies more dense in these two categories. Pre-heating and pre-drying the crown fuels easily makes them more susceptible for ignition. Wind speeds less than seasonal average will help an ignition in the crown fuels develop more heat intensity and sustain an active crown fire.

Alternative A Post Treatment FRCC Condition Class Indicator

Within the fire regime condition classes, stands are further classified according to their structure or strata development stage. The 'bridge' between stand structures/strata and FRCC is canopy closure. The Forest Vegetation Strata Classification System and FRCC have the same canopy closure criteria of 0-40, 40-70, and 70% plus. FRCC 3 is represented by stands that still have canopy cover of at least 69 percent. FRCC 2 (moderate departure) is represented by stands with a canopy cover of 35 – 47 %, i.e. near 40%, which are the criteria used in both Stand Structure Classification System and Fire Condition Classes.

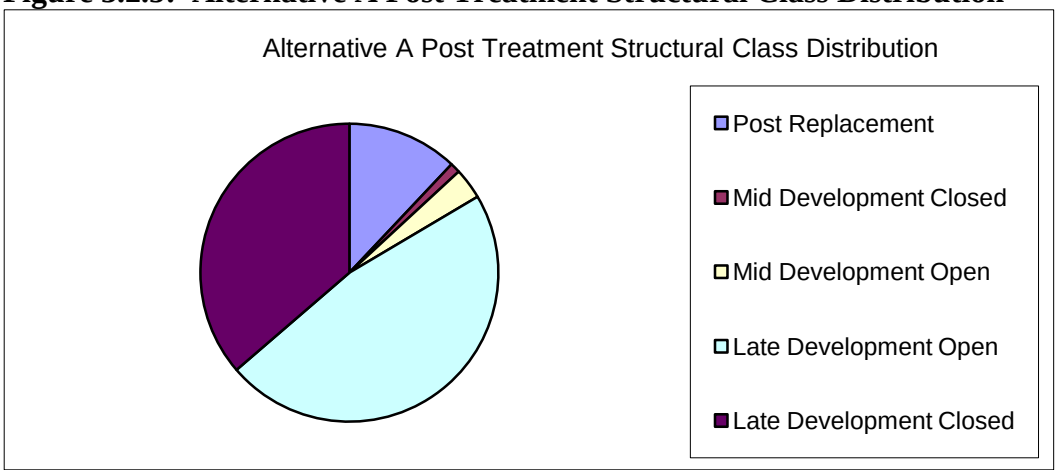
Alternative A would have a positive benefit on FRCC because it provides a process for moving the landscape closer to reference conditions (Table 3.2.6). Post treatments modified 4,005 acres to a FRCC closer to the natural departure interval. This is primarily a result of treatments that modified late development closed vegetative structure class to mid and late development open class. While this is still far from the reference percentage, according to the Black Hills PNVG, it is a marked improvement from the current conditions (Figure 3.2.6). The effectiveness of the proposed fuels treatments could last up to 20 years (Battaglia et al., 2008). In addition fuel treatments in this alternative re-introduced fire into the ecosystem. Under Alternative A, the Fire Regime Condition Class would be reduced to a Condition Class 2.

Table 3.2.6: BCLMP- Alternative A Post-Treatment FRCC Distribution.

Structural Class	Reference Percent	Existing Percent	Proposed Treatment Percent
Post Replacement	10%	1%	12%
Mid Development Closed	15%	2%	1%
Mid Development Open	25%	2%	4%
Late Development Open	40%	21%	47%
Late Development Closed	10%	74%	36%

Figure 3.2.5 provides a visual display of Alternative A stand structural class distribution.

Figure 3.2.5: Alternative A Post Treatment Structural Class Distribution



Implementation of Alternative A fuel treatments indicate there is still an under-representation in the mid development classes as compared to the reference conditions (Table 3.2.6). Overall, treatments would remove a large portion of ladder fuels, thus raising the canopy base heights to at least 16 feet – a level where torching potential is reduced except under rare scenarios of extremely high winds. Harvesting some of the overstory would help create more of the open stand structure and promote young stands developing into mid development stands in the future. This was the major objective when selecting stands for treatment in the project area. A more extensive use of prescribed fire in this proposed alternative is expected to be an effective and most cost efficient means in reducing surface fuels and managing the ladder fuel layer.

B. CUMULATIVE EFFECTS OF PROPOSED ACTION ON FUELS

Fire Management & Fuel Accumulation

The proposed action alternative results in achieving both short and long term fire management goals outlined in the Forest and Fire Management Plans. Stand conditions would be such that there would be an increased opportunity to implement the full range of fire management response options, particularly managing wildfire with resource benefit objectives. The ability to implement periodic prescribed maintenance burns would be enhanced and become an increased fire management activity.

Fuel management objective is to create a heterogeneous landscape with various opportunities for firefighters to make safe, reasonable, strategic and tactical decisions. A fuel situation across the landscape that is contiguous either in kind or amount is problematic for suppression efforts and has potential for a large-scale wildfire. Without this type of landscape appropriate fire suppression response is limited and firefighter safety is more at risk. An ignition can develop heat intensity quickly and advance geometrically into extreme fire behavior.

A ‘heterogeneous’ vegetative community has its own inherent fire protection pattern. Fire would burn where there are fuels or a situation that matches the natural fire regime for the area. Some

vegetative areas within the landscape are not yet "ready to burn." Fire spread lessens, heat intensity reduces, and sometime the fire extinguishes itself naturally. Wildfires that occur in areas without this mosaic pattern can exhibit uncharacteristic, often long term effects on the plant community that is adapted to the area.

Although an immediate decrease in the ladder and aerial fuels would be realized by the thinning treatments, a short-term increase of surface fuels from limbs, tops, and slashed material created would increase surface fire hazard before either grapple-piled, hand piling or under burning would be implemented. This short-term increase of surface fuels may not occur in units where it is a purchaser requirement or the purchaser opts to remove fuels at the same time as harvest. Harvest activities that occur in late fall or early winter decrease the fire hazard since the activity fuels over winter or are on the ground during periods of very low fire danger and treated the following spring. Over wintering of slash fuels is also thought to provide possible leached nutrients back to the soil. Although an increased short-term high heat intensity fire hazard may exist at the surface, the potential for a stand replacement burn is probably an acceptable risk as long as ladder and canopy fuels were treated.

Grazing

Permitted livestock grazing is not likely to negatively contribute to cumulative effects. While most of the BCLMP area is currently managed for grazing, the most likely effect would be reduction of fine fuels. Grass is expected to increase in forested stands that are treated to a more open canopy closure. Whether or not that affects Range Management Standards as to utilization per allotment during the grazing season is not known (See Section 3.7 - Range).

When prescribed burning in done, there is a potential for invasion of noxious weeds, especially in some 'micro sites' where high heat intensity occurred due to fuel concentrations or wind shifts during the burn. This effect is usually considered in the Prescribed Burn Plan with appropriate measures identified for on-going monitoring and corrective measures if necessary. Please refer to the Noxious Weed portion of Chapter 3 for additional information.

Firefighter Safety

Firefighter safety can be measured by the ability to effectively control a wildfire incident. Flame lengths are often referred to as an indicator of control possibilities, suppression tactics and firefighter safety. Direct attack or suppressing a fire near the fire edge is possible for hand crews when the flame lengths are less than 4 feet (NFES#2165, 2006 page B-59). Flame lengths greater than 4 feet generate heat intensity that cannot be tolerated by the human being without lung damage or threat of serious injury or fatality.

Experience and current reviews emphasize that firefighters can more safely fight a fire if:

- It stays small (low rate of spread; largely determined by small fuels),
- Has lower heat intensities (determined by fuel structure and accumulation),
- Has relatively little spotting potential (determined by potential firebrand sources, how far they travel, and probability of ignition upon landing), and

- Low resistance or difficulty of control (suppression force required to control a unit of fire perimeter; determined by amount of dead and down fuels).

Private residences and buildings in and adjacent to the BCLMP area are quite often built near the creek bottoms and grasslands. The adjacent wild land fuels are predominately grass and shrub types. This is a relatively safe and defensible position for the property, human and firefighter safety. In areas where the canopy has been reduced to less than 40%, surface fuel loading kept below 7 ton/acre, and there is no or only limited ladder fuels remaining (which is indicated by crown base height), there is a reduced risk of fire escaping onto private property or being a threat to public safety.

All three Action Alternatives A, B and C provide a greater safety margin for the public, the firefighter, and ensure greater protection of private property than what results from the No Action Alternative. Alternatives A & B would yield a higher level of safety since it reduces the canopy closure in more stands. Approximately 1,467 acres were eliminated from treatment in Alternative C, which is a detriment to firefighter safety similar to Alternative D. As noted in Table 3.2.7 there is less chance of fire spreading into the crown fuel layer when canopy cover is below 40%. Once fire is in the crown layer, there is an increased chance that the usual wind pattern for this area would help sustain its movement and/or potential for erratic behavior of spotting and crown spread erratically across the landscape.

Table 3.2.7: NEXUS Torching and Crown Fire Indices

Canopy Cover	Canopy Base Height	Surface Fuels	20 – Foot Wind Speed to Initiate Torching	20 – Foot Wind Speed to Sustain Crown an Active Crown Fire
69%	5	Average	15.5	11.9
69%	16	Average	47.5	11.9
52%	20	Average	58.1	13.2
47%	23	Average	65.8	17.6
35%	27	Average	75.8	21.2
23%	30	Average	19.6	26.4

Smoke Management

The Proposed Action Alternative would add smoke to an immediate area, but is not expected to exceed smoke management standards within a localized or cumulative area. Prescribed fire use would be implemented within existing standards and guidelines to avoid even short-term impacts.

Smoke management is regulated through the State of Montana's Department of Environmental Quality (DEQ). Prescribed burns are input into a smoke database before implementation, and if emissions will not exceed the NAAQS rates, the action will be approved. In addition, prescribed burns proposed under the BCLMP decision would be coordinated with the Montana/Idaho State Airshed Group (http://www.smokemu.org).

Direct effects of the burns include particulate emissions from prescribed burning and indirect effects would include some localized visibility reduction from the plumes. Outside of the minimum

ambient distances, the smoke concentrations are expected to be within NAAQS and State of Montana air quality standards. For additional discussion, please refer to the Air Quality Section of this EIS.

C. OTHER REQUIRED DISCLOSURES WITH PROPOSED ACTION

Irreversible/Irretrievable of Proposed Action

An "irreversible" commitment results from a decision to use or modify resources that are renewable over a period of time. Most resources associated with a wildland environment are renewable. An "irretrievable" commitment of resources refers to resources, resource production or the use of a resource that is lost because of land allocation or scheduling decisions. A resource such as minerals is an example of an irreversible/irretrievable commitment if used. Fire and fuel related activities are not intended to cause irreversible/irretrievable results. However without implementation of this proposed action, the effects from a likely high intensity, high severity stand replacement burn might be viewed as irreversible/irretrievable since the effects on the landscape and resources could exist for years, possibly a century or two.

Unavoidable Adverse Effects of Proposed Action

Fire and fuel related activities planned with this alternative would not cause unavoidable adverse effects upon the land or resources. With prescribed fire use, it maybe necessary to establish containment lines in some units, but intentions are to utilize tactics that don't cause short or long term adverse impacts/effects upon the land and resources.

Forest Plan Consistency of Proposed Action Alternative

This alternative would be consistent with the Forest Plan as it proposes to use prescribed fire to help meet the goals of the MA's within the analysis area. This alternative would take action to reduce wildland fuels and lessen heat intensity and behavior – preventative steps towards the protection of human life and property within/adjacent to the analysis area and special designated resource areas. Reduction of fuels would also help the initial attack organization meet their fire management objectives, as activity fuels would be treated in order to reduce fire intensities that allow for safe direct attack. This alternative would help develop cost-effective fire programs by reducing potential intensities of wildfires and therefore the costs of managing potential wildfires.

D. CONCLUSIONS OF EFFECTS FOR ALTERNATIVE A

Under Alternative A, approximately 9000 acres post treatment would consist of stands that would not initiate torching or sustain crown fire under the average peak wind conditions. Another 1300 acres of Commercial Thin for Wildlife would consist of stands that would not initiate torching under the average peak wind conditions but could sustain crown fire. Alternative A no treatment acres total 3545 and would be susceptible to both torching and sustaining crown fire under average peak wind conditions.

Alternative A treatments would result in treating 10,500 acres of the existing canopy and mid level fuels and lessens the potential for a stand replacement, high severity wildfire that causes

long-term adverse effects. Post treatment stand structure and fuels situation represents conditions less conducive for a fire to easily transition from surface to a crown fire. Conversely, should a fire spread into the proposed treatment area from outside, post treatment conditions should alter the behavior to be more of a surface fire with less heat intensity. Such change in behavior would provide opportunity for greater flexibility in managing fire for multiple objectives (i.e. protection and resource benefit). The treatment units that create larger sized openings (40 acre +) increase the opportunity for firefighting forces to safely and effectively mange even a fairly large size advancing wildfire.

Alternative A treatments would modify 4,005 acres to a FRCC closer to the natural departure interval. This is primarily a result of treatments that modified late development closed vegetative structure class to mid and late development open class. While this is still far from the reference percentage, according to the Black Hills PNVG, it is a marked improvement from the current conditions (Figure 3.2.6).

The removal of mid-level and canopy fuels would result in increased sunlight that ultimately affects surface fuel temperature as well as fuel moisture content. Prescribe fire use would consume some existing surface vegetation and decrease down woody material and duff layer, although burning prescriptions have objectives for fuel amounts and especially course woody material (CWD) to be retained on site. Most likely there would be a rejuvenation of grasses and forbs following prescribed fire use (see Forest Vegetation Specialist Report in Project Record).

Alteration of the stand structure and prescribed fire use is likely to result in ground vegetation with a proportionate increase of grasses often typed as open grass savannah. This increase of fine surface fuels usually exhibits faster spread rates and heat intensity than a surface layer of pine needles and small woody fuels. However the heat intensity is short duration and with lack of ladder fuels the probability of causing ignition in the overstory canopy fuels is low. The more open stand structure also increases the management options for firefighting forces. Ultimately this creates a greater safety margin for the public, the firefighter, and ensures greater protection of private property than what results from the No Action Alternative.

This alternative closely approaches the objectives of the purpose and need. It accommodates treatment of 1300 acres for wildlife resource concerns. It provides a gradual movement toward a mosaic of stands strata distribution with less homogeneity over the landscape. This movement toward a more heterogeneous landscape is more likely to reduce overall fire severity and size. This alternative lends itself to a situation in which the land/fire manager has opportunity to manage the fire for a variety of objectives versus needing to respond with a costly suppression effort. It provides a vegetative situation with different stand ages and structure. It provides the opportunity to manage for total forest resource needs.

V. EFFECTS OF ALTERNATIVE B ON FUELS - PREFERRED ALTERNATIVE

A. DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE B ON FUELS

The direct and indirect effects and specific discussion with each category in Alternative A applies with the fuel treatments and categories in Alternative B. Both alternatives target treatment of the three fuel layers that support large scale, high severity stand replacement wildfires: canopy, ladder and surface fuels. Treatment units in the Commercial and Non-commercial Categories are still where most treatment activity is occurring. There is a minimal acreage difference (approximately 1%) between the two categories. All options are available to treat surface fuel including prescribed fire, except on the treated units in the Wildlife Category. Prescribed burning is not an option that category.

Overall the end-result with this alternative would be a positive effect in lessening stand replacement potential and promoting advancement toward the vegetative structure class for this fire regime area.

Commercial Thin Category Treatments: CT, SC

Post treatment stands would resemble mid or late strata development fairly open stands with canopy closure in the range of 20 – 30, crown base height averaging 20-30 feet and surface woody fuel loading the same as specified in Alternative A. All other specifics and especially those related to prescribed fire use that are outlined with this category in Alternative A are also applicable with Alternative B.

Fuel treatments would occur on 186 acres, just 36 less than Alternative A. Within these treated units, 27 acres would not include prescribed underburning because it is assessed that heat intensity from a surface fire would result in exceeding acceptable overstory morality. This would need to be assessed at the time of developing the prescribed burn plan. In units where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Commercial Thin--Regeneration Category Treatments: ST1, SH1

Post treatment stands would resemble mid open to late open strata development. They would be more open than the previous category with canopy closure ranging between 5 – 15% in ST1 units and between 15 – 25% in SH1 treated units. Reducing stand replacement wildfire potential would be achieved on 906 acres. Included in these treated units are 178 acres without prescribed underburning. Some units treated in this category would exceed 40 acres in size.

All other specifics for this category and especially those related to prescribed fire use outlined with this same category in Alternative A are also applicable with this Alternative B.

Non-Commercial Category Treatments: NC4, NC5, NC1, NC2, NC3, RXB, SCNC

Post treatment stands would resemble mid or late open strata development having a fairly open canopy closure ranging from 10 – 40 % with some units being closer to 50%. Nearly 81% of the treated units in this category would resemble late-open development class but with a diverse understory. Crown base height average 15-20 feet. All discussion and specifics regarding surface fuel loading and prescribed fire use addressed with this category in Alternative A are also applicable in this Alternative B.

Implementation of this alternative is expected to reduce potential for stand replacement fire on 7,902 acres. This is a 208-acre increase than Alternative A. Within the treated units, 810 acres would exclude prescribed underburning since it is assessed that burning in the increased surface fuel loading would cause a heat intensity that would exceed acceptable overstory mortality. In units where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Post Replacement Category Treatments: LIB, PCT, STR, STR1

Post treatment prescription for these stands are intended to resemble mid to late developed stands with a canopy closure near 40%. Crown base height averages 10 feet. All discussion and specifics related to surface fuel loading, treatment options and prescribed fire use outlined with this category in Alternative A are also applicable with this Alternative B.

A reduction in potential stand replacement burns would be achieved on 278 acres, the same as Alternative A in this category. Within these treated units, 198 acres would exclude prescribed underburning since it is assessed the surface fuel loading will result in sufficient heat intensity to exceed acceptable overstory mortality limits (see Chapter 2, Table 2.8). However, this mortality increase is not expected to exceed the fire created overstory tree mortality limits identified in this table.

Treatments would improve canopy spacing and lessen ladder fuels to some degree, but also result in an increase surface fuel loading as a short-term fire risk. In these areas where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Commercial Thin/ Wildlife Category Treatments: CT1

Treated stands would resemble a late development closed canopy appearance with limited ladder fuels and areas of higher stocking densities to promote high canopy coverage to maintain goshawk habitat over the long term. All discussion and other specifics related to surface fuel loading and prescribed fire use outlined with this category in Alternative A are also applicable with this Alternative B.

With Alternative B approximately 1,238 acres (CT1) would be thinned from below but not to

exceed a stand canopy cover of 50%. Ladder fuels would be limited resulting in a crown base height of 15 feet. Fuel treatments in this category would not include prescribed burning, because surface fuel loading are assessed to be at a level in which burning poses a high risk of exceeding acceptable morality (See Chapter 2, Table 2.8).

Alternative B Torching and Crowning Risk Indicator

The discussion and specifics outlined in Alternative A with this indicator are also pertinent for this alternative. The amount and type of fuel treatments, except for a 1% difference with acres between the commercial and non-commercial categories is the same for both alternatives.

Overall, treatments identified in Alternative B would reduce potential stand replacement acres over a majority of the project area. This is primarily from treatments that occurred in the commercial and non-commercial categories. Post treatment conditions would require wind speeds far greater than what normally occurs throughout the fire season to sustain an active crown fire. Treatments would achieve stand conditions with a CBH above 16 feet and a canopy closures at 40% or less (Table 3.2.8.)

Table 3.2.8: Alternative B: NEXUS Post Treatment Results and Acres by Treatment Category.

Treatment Categories	Acres Treated Alt. B	Canopy Cover	Canopy Base Height	20 – Foot Wind Speed to Initiate Torching (Torching Index)	20 – Foot Wind Speed to Sustain Active Crown Fire (Crowning Index)
Commercial Thin	185	23%	30	83.2	31.6
Commercial Thin/Regen	905	23%	30	83.2	31.6
Non Commercial	7902	35%	16	47.5	24.4
Comm. Thin Wildlife	1238	52%	12	36.6	15.4
Post Replacement	278	52%	10	30.9	15.4
No Treatment	3545	69%	5	15.5	13.9

Alternative B Post Treatment FRCC Condition Class Indicator

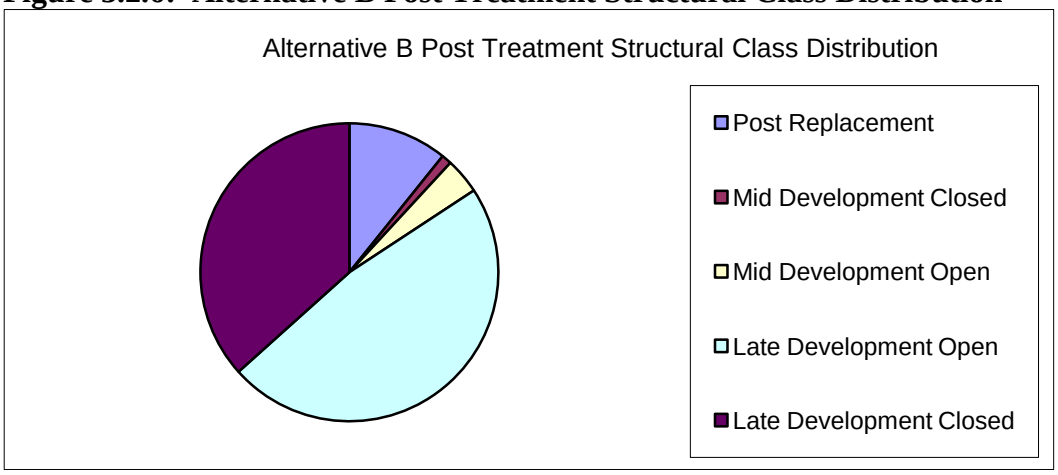
Except for 169 acres moving from commercial to non-commercial and moving 29 aces from wildlife to the non-commercial category, the end result structural distribution across the landscape can be assessed as essentially the same as Alternative A. Treatments in both the commercial and non-commercial category result in a mid-development open or late development open structural class with crown basal heights near 20 feet and canopy closure less than 40%. In comparing values in Table 3.2.9 it is noted that there is still an under-representation in the mid development classes as compared to the reference conditions over the landscape, the same as Alternative A. Refer to the narrative in Alternative A, Post Treatment Structural Class Distribution for additional discussion and specifics related to analysis of this indicator with

values observed for Alternatives A and B. Figure 3.2.6 provides a visual display of stand structural class distribution.

Table 3.2.9: BCLMP- Alternative B Post-Treatment FRCC Distribution.

Structural Class	Reference Percent	Existing Percent	Proposed Treatment Percent
Post Replacement	10%	1%	11%
Mid Development Closed	15%	2%	1%
Mid Development Open	25%	2%	4%
Late Development Open	40%	21%	48%
Late Development Closed	10%	74%	36%

Figure 3.2.6: Alternative B Post Treatment Structural Class Distribution



The opportunities to utilize treatments such as overstory removal and yet provide measures to prevent damage to the residual understory were major criterion when selecting stands for fuel treatment in the project area. The major objective was create stand conditions that would promote mid development structural classes in the near future.

B. CUMULATIVE EFFECTS

Fire Management & Fuel Accumulation

Refer to same section in Alternative A

Grazing

Refer to same section in Alternative A

Firefighter Safety

Refer to same section in Alternative A

Smoke Management

Refer to same section in Alternative A

C. OTHER REQUIRED DISCLOSURES FOR ALTERNATIVE B

Refer to same section in Alternative A

D. CONCLUSIONS OF EFFECTS FOR ALTERNATIVE B

Under Alternative B, there is still approximately 9000 acres post treatment that would consist of stands that would not initiate torching or sustain crown fire under the average peak wind conditions. Another 1200 acres (approximately 100 acres less than Alternative A) of Commercial Thin for Wildlife would consist of stands that would not initiate torching under the average peak wind conditions but could sustain crown fire. Alternative B no treatment acres are the same as for Alternative A (3545 acres) and would be susceptible to both torching and sustaining crown fire under average peak wind conditions.

Alternative B treatments would result in treating 10,500 acres of the existing canopy and mid level fuels and lessens the potential for a stand replacement, high severity wildfire that causes long-term adverse effects. This alternative would realize all of the fuels benefits for reducing susceptibility to stand replacement fire identified in the Alternative A conclusion.

Except for 169 acres moving from commercial to non-commercial and moving 29 aces from wildlife to the non-commercial category, the end result structural distribution across the landscape can be assessed as essentially the same as Alternative A. This alternative would result in the same stand structure modifications as identified in Alternative A.

The more open stand structure again increases the management options for firefighting forces. Ultimately this creates a greater safety margin for the public, the firefighter, and ensures greater protection of private property than what results from the No Action Alternative.

This alternative also closely approaches the objectives of the purpose and need. It accommodates treatment of 1200 acres for wildlife resource concerns. It provides a gradual movement toward a mosaic of stands strata distribution with less homogeneity over the landscape. This movement toward a more heterogeneous landscape is more likely to reduce overall fire severity and size. This alternative lends itself to a situation in which the land/fire manager has opportunity to manage the fire for a variety of objectives versus needing to respond with a costly suppression effort. It provides a vegetative situation with different stand ages and structure. It provides the opportunity to manage for total forest resource needs.

VI. EFFECTS OF ALTERNATIVE C ON FUELS

A. DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE C ON FUELS

Overall, treatments identified in Alternative C would be approximately 15% less than in Alternatives A and B and thus reduce the overall effectiveness of reducing potential stand replacement wildfire across the project area. This is mostly the result of treatments in the Commercial and Non-commercial categories, since no fuel treatment would be done in the wildlife category and only 78 acres would be treated in the post treatment category. The main objective in this alternative is to retain current stand conditions in the identified goshawk PFA's. The potential for a high severity stand replacement fire remains at a high risk in these PFA's (note values and discussion in the Torching and Crown Fire Indicator Section). Wind speeds common throughout the fire season could easily initiate torching and sustain an active crown fire. Typical average summer conditions are: temperature at 85 degrees F; 1-hour fuel moisture at 2%; and twenty-foot wind at 17 mph.

Commercial Thin Category Treatments: CT, SC

Post treatment stands would resemble mid or late strata development fairly open stands with canopy closure in the range of 20 – 30%, crown base height averaging 20-30 feet and surface woody fuel loading the same as specified in Alternative A. All other specifics related to post treatment conditions, fuels and prescribed fire use that is discussed in this category with Alternative A also applicable with Alternative C.

Fuel treatments with this alternative would occur on 156 acres of which 4 would not include prescribed underburning. It is assessed that heat intensity from a surface fire would result in exceeding acceptable overstory morality. This would need to be assessed at the time of developing the prescribed burn plan. In units where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Commercial Thin -- Regeneration Category Treatments: ST1, SH1

Post treatment stands would resemble mid open to late open strata development. They would be more open than the previous category with canopy closure ranging between 5 – 15% in ST1 units and between 15 – 25% in SH1 treated units. Reducing stand replacement wildfire potential would be achieved on 702 acres. Included in these treated units are 53 acres without prescribed underburning. Some units treated in this category would exceed 40 acres in size.

All other specifics for this category and especially those related to prescribed fire use outlined with this same category in Alternative A are also applicable with this Alternative B.

Non-Commercial Category Treatments: NC4, NC5, NC1, NC2, NC3, RXB, SCNC

Post treatment stands would resemble mid or late open strata development having a fairly open canopy closure ranging from 10 – 40 % with some units being closer to 50%. Nearly 83% of the treated units in this category would resemble late-open development class but with a diverse understory. Crown base height average 15-20 feet. All discussion and specifics regarding surface fuel loading and prescribed fire use addressed with this category in Alternative A are also applicable in this Alternative C.

Fuel treatments with this alternative would occur on 7123 acres of which 366 would not include prescribed underburning. It is assessed that heat intensity from a surface fire would result in exceeding acceptable overstory morality. This would need to be assessed at the time of developing the prescribed burn plan. In units where burning will not be done, either some mechanical or pile and burn fuel treatment would be necessary to reduce surface fuel loadings to a level identified in the prescription and contributes in lessening potential stand replacement burns.

Post Replacement Category Fuels Treatments: LIB, PCT, STR, STR1

Post treatment stands would more closely resemble mid to late development strata, partially open with a canopy closure higher than 40%. Only 78 acres are being treated in this category with this alternative. This was the result of eliminating 200 acres that were in identified PFA areas. Ladder fuels would be limited with a crown base height averaging 10 feet. Surface woody fuel loading would be at upper end of 3 – 7 ton/acre, of which 0-3 inch diameter would not exceed 3 tons/acre, and 3-12 inch plus diameter is a minimum of 3 tons/acre (with 50% being 12” and larger when available).

Fuel treatments with this alternative would occur on 78 acres. A follow-up prescribed underburn is planned on all this area except 7 acres.

All other specifics and discussion related to fuels and prescribed fire use is the same as mentioned with this category in Alternatives A & B.

Commercial Thin/Wildlife Treatments: CT1

No treatments in this category. This is identified PFA area. Crowing and Torching Index values related to this category would the same as observed with the No Treatment alternative. These stands would remain vulnerable to stand replacement wildfire.

Alternative C Torching and Crowning Risk Indicator

Treatments identified in Alternative C would reduce potential stand replacement acres over 7982 acres of the project area. This is primarily from treatments that occurred in the commercial and non-commercial categories, which result in a more open stand structure with crown base heights near 20 feet and canopy closure less than 40%. In these situations a wind speed far greater than what normally occurs throughout the fire season to initiate torching and to sustain a crown fire.

In comparison with Alternatives A & B, this alternative reduced treatment in the Post Replacement Category by 200 acres and eliminated all treatment in the Wildlife Category (1267 acres), which adds 1467 acres within the BCLMP Area as no treatment. This is approximately a 15 % increase of area that is now vulnerable for large-scale stand replacement fire (Note values in Table 3.2.10 for stands with canopy closure above 50% and crown base heights near 10-12 feet).

Additional discussion and specifics related to this indicator are the same as addressed in Alternative A.

Table 3.2.10: Alternative C: NEXUS Post Treatment Results and Acres by Treatment Category

Treatment Categories	Acres Treated Alt. C	Canopy Cover	Canopy Base Height	20 – Foot Wind Speed to Initiate Torching (Torching Index)	20 – Foot Wind Speed to Sustain Active Crown Fire (Crowning Index)
Commercial Thin	156	23%	30	83.2	31.6
Commercial Thin/Regen	703	23%	30	83.2	31.6
Non Commercial	7123	35%	16	47.5	24.4
Comm. Thin Wildlife	0	52%	12	36.6	15.4
Post Replacement	78	52%	10	30.9	15.4
No Treatment	5993	69%	5	15.5	13.9

Alternative C Fire Regime Condition Class (FRCC) Distribution

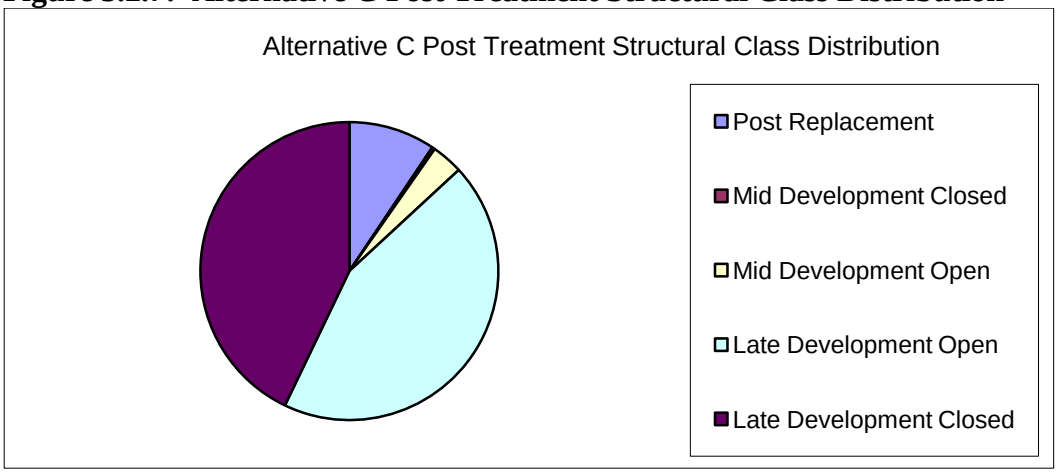
Post treatment FRCC structural class distribution across the landscape is similar to Alternatives A and B. Post treatment conditions in Alternatives A and B resulted in an under-representation in the mid development classes over the landscape as compared to reference conditions. An obvious difference with structural class distribution is a 7% increase in the late development closed strata and a 4% decrease of the late open strata. In this alternative, 1238 acres originally identified for treatment in PFA's (Wildlife Category) were not included in this alternative (compare values in Table 3.2.10. and Table 3.2.8.).

Refer to the narrative in Alternative A, Post Treatment Structural Class Distribution for additional discussion and specifics related to analysis using the FRCC as an Indicator. Figure 3.2.7 provides a visual display of stand structural class distribution for Alternative C.

Table 3.2.11: BCLMP- Alternative C Post-Treatment FRCC Distribution.

Structural Class	Reference Percent	Existing Percent	Proposed Treatment Percent
Post Replacement	10%	1%	10%
Mid Development Closed	15%	2%	0%
Mid Development Open	25%	2%	3%
Late Development Open	40%	21%	44%
Late Development Closed	10%	74%	43%

Figure 3.2.7: Alternative C Post Treatment Structural Class Distribution



B. CUMULATIVE EFFECTS

Fire Management & Fuel Accumulation

The proposed alternative results in achieving some short and long-term fire management goals outlined in the Forest and Fire Management Plans. Stand conditions would be such that there would be some increased opportunity to implement the full range of fire management response options, particularly managing for resource benefits. The lack of treatment in the PFA's leaves those stands susceptible to stand replacement fire and complete habitat loss which all but eliminates those areas from consideration for wildfire management with resource objectives. The ability to implement periodic prescribed maintenance burns would be limited to those areas of initial treatment.

Grazing

Refer to same section in Alternative A

Firefighter Safety

A majority of the discussion that was outlined with Alternative A in relation to this concern is applicable with this alternative.

Since no fuels treatment is planned in PFA's (approximately 1300 plus acres), this alternative would not mitigating risk toward public and firefighter safety to the same degree as accomplished with Alternatives A and B. Unplanned ignitions in the PFA's would be difficult to control and safely inserting firefighters would be difficult because of the potential fireline intensities. The PFA's also would not provide any resistance to an established crown fire. Since the PFA's boarder private land, there is an additional risk posed to the public by not treating those stands.

Smoke Management

The No Action alternative does not propose any prescribed burning treatments, so air quality standards would not be influenced by this project. In the event of an unplanned ignition and a stand replacement fire, air quality standards would likely be compromised in some area depending on wind direction at the time. See Section 3.13 - Air Quality of this EIS for additional discussion on air quality standards.

C. OTHER REQUIRED DISCLOSURES FOR ALTERNATIVE C

Refer to same section in Alternative A.

D. CONCLUSIONS OF EFFECTS FOR ALTERNATIVE C

Under Alternative C, approximately 8000 acres (approximately 1000 acres less than in Alternatives A and B) post treatment would consist of stands that would not initiate torching or sustain crown fire under the average peak wind conditions. All 1200-1300 acres of Commercial Thin for Wildlife would not be treated, thus losing those stands that would not initiate torching under the average peak wind conditions but could sustain crown fire. Alternative C no treatment acres total approximately 6000 acres (2500 acres more than Alternatives A and B) and would be susceptible to both torching and sustaining crown fire under average peak wind conditions.

Alternative C treatments would result in lowering the existing canopy and mid level fuels and lessen some of the potential for a stand replacement, high severity wildfire that causes long-term adverse effects, however this is approximately 2500 acres or 20% less than Alternatives A or B. Also, should a fire spread into the proposed treatment area from outside, post treatment conditions would be less likely to alter the behavior to be more of a surface fire. Flexibility to manage fire for multiple objectives (i.e. protection and resource benefit) would be reduced.

For Alternative C, post treatment structural class distribution is 7% greater in the late development closed strata and 4% less in the late open strata when compared to Alternatives A or B. In this alternative, 1238 acres originally identified for treatment in PFA's (Wildlife Category) were not included in this alternative (compare values in Table 3.2.10. and Table 3.2.8.).

The areas with more open stand structure will increase the management options for firefighting forces. Ultimately this creates a greater safety margin for the public, the firefighter, and ensures greater protection of private property than what results from the No Action Alternative.

However, this will be to lesser degree than in Alternatives A and B, especially in the untreated Goshawk PFA's that will consist of dense untreated stands.

This alternative meets some of the objectives of the purpose and need. However, it eliminates treatment of 1200-1300 acres for wildlife resource concerns, but by doing this leaves those wildlife stands susceptible to stand replacement fire under average weather conditions (17mph average peak sustained wind). This alternative provides 8000 acres outside the Goshawk PFA's in which the land/fire manager has opportunity to manage the fire for a variety of objectives versus needing to respond with a costly suppression effort.

VII. EFFECTS OF ALTERNATIVE D ON FUELS - NO ACTION

A. DIRECT & INDIRECT EFFECTS OF NO ACTION ALTERNATIVE ON FUELS

The No Action Alternative would not mitigate current fire hazard. The current fuel situation in conjunction with existing stand structure would leave the area susceptible to future large scale, high intensity and severity stands replacement wildfire. No positive direct or indirect effects are realized with this alternative. Currently 75% of the forested landscape in the project area has a closed canopy with fuel ladder fuels extending to the ground surface in many areas and a ground surface fuel readily susceptible for an ignition to occur from natural or human source and quickly develop heat intensity. Fuel situation especially at the low to mid layer easily allows a low intensity surface fire to transition into the crown fuels. As is noted by NEXUS Torching and Crown Fire Indices, once a fire is in the crown fuels only a moderate 20-foot wind speed of 13 or even 17 mph would most likely sustain the fire as crown fire. Thirteen to fifteen mph winds are almost a daily occurrence on the Ashland RD throughout the fire season.

The extensive area encompassed by readily susceptible crown fire stands support the scenario for a large-scale high severity wildfire across the landscape. The small percentage of stands in the project area that might only exhibit a moderate or even low fire behavior would also easily be affected with a large size fire in the more closed canopy stands. Without management actions at this time, the stands in the project area would continue to move toward an increasing potential for a high severity, long-term negative effecting wildfire.

A review of recent stand replacement wildfires that have occurred near the Beaver Creek Project adds to a scenario posing major management challenges. Around 8 – 10 years following the Stag Rock Wildfire (2000), approximately 80% of the fire created snags fell to the ground, creating a heavy surface fuel loading which significantly adds to the difficulty of fire suppression. In a recovering forest, if seedlings are present they would most likely be consumed by this increased fire behavior, further delaying reforestation.

A similar situation occurred with the Brewer Fire in 1988 on the Sioux Ranger District, a similar forested environment to the BCLMP area. In 2002, the Kraft Springs Fire occurred within the

perimeter of the 1988 Brewer Fire. During fire suppression activities it was noted that the addition of fire killed trees as partially decomposed surface fuels (exceeding 40 tons/acre in some places) quickly contributed to the heat intensity and significantly hampered initial attack efforts. Many of the naturally regenerated and planted stands within the Brewer Fire area were lost in the 2002 wildfire. The end result of the 1988 and 2002 fires was a 69% long-term loss of forested habitat.

This alternative would continue to limit options to manage unplanned ignitions both in terms of appropriate management suppression response(s) and the management of unplanned ignitions for resource objectives. The opportunity to implement a natural fuels program within the project area and the surrounding national forest lands would remain very limited.

Alternative D Torching and Crowning Risk Indicators

Referencing indices provided by the NEXUS Model, it is noted that winds common throughout the fire season can initiate tree-torching behavior (reference Table 3.2.12). Average fire season conditions values are: temperature at 85 degrees; fine fuel moisture at 2 %; and 20 foot wind speeds: at 17 mph. As noted earlier, 75% of the stands in the project area are closed canopy with a well-developed fuel ladder layer. These stands are represented in the table as 69% canopy cover and 5 feet canopy base height. Wind speeds less than the seasonal average (17 mph) would be sufficient to "fan" the torching behavior and initiate and sustain an active crown. Tree torching may not occur in stands represented by a closed canopy and a higher canopy base height, i.e. 16 – 20 feet, but these would still be very susceptible to sustained crown fire that might be initiated in another portion of the stand or an adjacent stand with a lower canopy base height. During site visits, it was observed there are scattered concentrations of surface fuels as result of past snow and wind damage. A fire in these concentrations would generate more heat intensity and persist for a longer duration than surface burning in other portions of the stand. Eventually branch and limb fuels at a higher base height could ignite and quickly spread upward through the remaining crown.

Another important aspect to recognize is the effect of a closed canopy with a fire burning in the surface fuels, even a low heat intensity fire. Convective heat from the fire is "capped" within the canopy fuels resulting in pre-drying and pre-heating of these fuels. The potential for torching is enhanced especially if there is a 'flare-up' or where burning has persisted for a longer duration.

Table 3.2.12: Torching Index And Crowning Index For Various Canopy Closure Levels.

Canopy Cover	Canopy Base Height	Surface Fuels	20 – Foot Wind Speed to Initiate Torching	20 – Foot Wind Speed to Sustain Crown an Active Crown Fire
69%	5	Average	15.5	11.9
69%	16	Average	47.5	11.9
52%	20	Average	58.1	13.2
47%	23	Average	65.8	17.6
35%	27	Average	75.8	21.2
23%	30	Average	19.6	26.4

Departure from Fire Regime Condition Class

The No Action alternative would have very little benefit on FRCC. The current stand distribution is approaching a homogenous pattern across the landscape. Currently 75% of the stands are late development closed canopy stands, which are highly susceptible to stand replacement wildfire. In comparison with the referenced FRCC stand structure model this is approximately a 65% departure. The other stand structures are less than the reference model by 25 – 35 % (Refer back to Table 3.2.1; Figures 3.2.3 and 3.2.4 for comparison). If on the other hand, should a stand replacement wildfire occur which could consume all or most of the existing closed canopy stands, a similar vegetation departure would exist, except instead of a landscape dominated by late development closed stands it would be dominated by post replacement stands.

Uncharacteristic fire behavior has been experienced in the past 3 – 4 decades. The current alternative promotes a situation for more large size, uncharacteristic stand replacing wildfires, resulting in the distribution of forest age classes and structure being further from the historic norm.

B. CUMULATIVE EFFECTS OF NO ACTION ALTERNATIVE

Fire Management & Fuel Accumulation

The usual fire management activities would continue. Although there is an approved plan to manage unplanned wildfire for resource benefits, the likelihood that this could happen within identified criteria with forested stands or adjacent areas within the project area is questionable. As was discussed in the Direct and Indirect Section (Section A) fuels would continue to increase. This would be most obvious with a denser ladder fuel layer and an increase surface fuel loading in the form of tree litter and mortality of trees from disease, storms or competition. A majority of future fire management activity would be protection and less opportunity to manage unplanned ignitions for resource benefits. Wildfire management can be expected to become more difficult and more costly.

Grazing

Under the No Action Alternative, grazing would continue unaffected. Currently there is standard of no more than 55% utilization on an allotment during the grazing season.

Firefighter Safety

The No Action Alternative does not propose a change with stand conditions. Since 75% of the forested stands in the BCLMP have high potential for crown fire and exhibiting extreme behavior it is not expected firefighter and public safety would be improved.

Firefighter safety can be measured by the ability to effectively control a wildfire incident. Flame lengths are often referred to as an indicator of control possibilities, suppression tactics and firefighter safety. With the current total fuel complex existing in the project area, flame lengths associated with a wildfire would be beyond the limits considered as being a safe working situation. Direct attack or suppressing a fire near the fire edge would not be a safe or effective

decision. Four-foot flame lengths are regarded as the upper limits to be a safe and effect situation for firefighter hand crew (NFES#2165, 2006 page B-59). Flame lengths greater than 4 feet generate heat intensity that cannot be tolerated by the human being without lung damage or threat of serious injury or fatality.

A wildfire occurrence in the project area would also pose threat to private residences and buildings in and adjacent to the BCLMP area. Wild land fuels that predominately grass and shrub types might be assessed as a relatively safe and defensible position for the property, human and firefighter safety should the fire originate in this type. But with a major stand replacement, crown fire within the vicinity, defensibility and human/firefighter safety is likely to be marginal.

C. OTHER REQUIRED DISCLOSURES WITH NO ACTION ALTERNATIVE

Irreversible/Irretrievable Commitments of No Action Alternative

The potential for large scale high severity stand burn can be seen as an irreversible/irretrievable effect on the forested environment since the effects on resource management would be noted for a long duration lessening accomplishment of forest management plan goals and objectives.

Unavoidable Adverse Effects of No Action Alternative

No unavoidable adverse effects are anticipated with the No Action Alternative.

Forest Plan Consistency of No Action Alternative

The No Action Alternative would not take any action to protect human life and property within the analysis area from an uncontrolled and unwanted wildfire. The No Action alternative would not use prescribed fire to help meet the goals of the MA's within the analysis area. It would not help develop cost-effective fire programs because it is reasonable to expect more intense fire behavior than in treated stands, thus control would be more difficult and likely require a greater number and type of suppression resources. The continued lack of fuels management would be inconsistent with the Forest plan goals, objectives, and standards because of the continued trend in undesired fire behavior.

D. CONCLUSIONS FOR EFFECT OF NO ACTION ALTERNATIVE ON FUELS

This alternative would not meet the purpose and need for this project. The No Action Alternative would not mitigate current fire hazard. The current fuel situation in conjunction with existing stand structure would leave the area susceptible to future large scale, high intensity and severity stands replacement wildfire. No positive direct or indirect effects are realized with this alternative. Wind speeds less than the seasonal average (17 mph) would be sufficient to "fan" the torching behavior and initiate and sustain an active crown.

The No Action alternative would have very little benefit on FRCC. The current stand distribution is approaching a homogenous pattern across the landscape. Currently 75% of the stands are late development closed canopy stands, which are highly susceptible to stand replacement wildfire. In comparison with the referenced FRCC stand structure model this is approximately a 65% departure.

The No Action Alternative does not propose a change with stand conditions. Since 75% of the forested stands in the BCLMP have high potential for crown fire and exhibiting extreme behavior it is not expected firefighter and public safety would be improved.

The No Action Alternative would not mitigate current stand susceptibility to stand replacement fire nor would it move the project area any closer to the PNVG reference conditions.